

**WHAT IS CLAIMED IS:**

1        1.        An acoustic telemetry apparatus for transmitting signals from a first location  
2        within a well borehole to a second location, comprising:

- 3                    (a)        an elongated member having a longitudinal bore;
- 4                    (b)        a reaction mass moveably disposed on the elongated member;
- 5                    and
- 6                    (c)        an actuator coupled to the elongated member and the reaction  
7                    mass, the actuator capable of inducing an axial reciprocating  
8                    movement of reaction mass relative to the elongated tube,  
9                    whereby the reciprocating movement causes an acoustic wave  
10                    to transmit into the elongated member, the acoustic wave being  
11                    indicative of the signal.

1        2.        An apparatus according to claim 1, further comprising a controller for  
2        controlling the apparatus.

1        3.        An apparatus according to claim 1, further comprising a displacement sensor  
2        for sensing a position of the reaction mass relative to the elongated member.

1 4. An apparatus according to claim 1, further comprising a controller, a  
2 displacement sensor and a feedback loop connected to the sensor and controller for  
3 conveying an output of the displacement sensor to the controller, the conveyed  
4 output at least partially determinative of controller actions in controlling the actuator.

1 5. The apparatus of claim 1, wherein the elongated member is selected from a  
2 group consisting of (i) a jointed drill pipe, (ii) a coiled tube, and (iii) a production tube.

1 6. The apparatus of claim 1, wherein the actuator is at least one electromagnetic  
2 device coupled to the reaction mass and to the elongated tube.

1 7. The apparatus of claim 6, wherein the at least one electromagnetic device is  
2 a linear electromagnetic drive.

1 8. The apparatus of claim 6, wherein the at least one electromagnetic device is  
2 at least two electromagnetic devices comprising a first electromagnetic device and a  
3 second electromagnetic device, the first electromagnetic device coupled being  
4 coupled to the reaction mass at a third location and the second electromagnetic  
5 device being coupled to the reaction mass at a fourth location spaced apart from the  
6 third location.

1 9. The apparatus of claim 1, wherein the actuator is coupled to the reaction  
2 mass with a biasing element.

- 1 10. The apparatus of claim 9, wherein the biasing element is at least one spring.
- 1 11. The apparatus of claim 1, wherein the reciprocating movement is an  
2 oscillation at a predetermined frequency.
- 1 12. The apparatus of claim 11, wherein the predetermined frequency is a  
2 resonant frequency.
- 1 13. The apparatus of claim 1, wherein the actuator is a fluid control device.
- 1 14. An apparatus according to claim 1, wherein the fluid control device is a fast  
2 operating valve.
- 1 15. An apparatus according to claim 13, wherein the fluid control device is a  
2 rotating valve.
- 1 16. An apparatus according to claim 15, further comprising a motor for operating  
2 the rotating valve.
- 1 17. The apparatus according to claim 16, wherein the motor is selected from a  
2 group consisting of (i) a synchronous motor and (ii) a stepper motor.

1 18. The apparatus according to claim **13**, wherein the fluid control device is a  
2 variable flow restrictor.

1 19. The apparatus of claim **18**, wherein the variable flow restrictor is a poppet  
2 valve.

1 20. The apparatus of claim **19**, wherein the flow restrictor further comprises a pilot  
2 valve.

1 21. The apparatus of claim **13**, wherein the first passageway is a substantially  
2 annular space between the reaction mass and the elongated member and extending  
3 at least partially along the length of the reaction mass.

1 22. The apparatus of claim **13**, wherein the first passageway is a central bore  
2 extending through the reaction mass.

1 23. A method of transmitting a signal from a first location within a well borehole to  
2 a second location comprising:

3 (a) conveying into the borehole on an elongated member having a  
4 longitudinal bore, a reaction mass and an acoustic actuator, the  
5 reaction mass being movably disposed on the elongated  
6 member and operatively coupled to the acoustic actuator; and

7 (b) enhancing a reciprocating movement in the reaction mass using  
8 the acoustic actuator whereby the reciprocating movement  
9 causes an acoustic wave to transmit into the elongated  
10 member, the acoustic wave being indicative of the signal;

1 24. The method of claim **23**, further comprising controlling the acoustic actuator  
2 with a controller.

1 25. The method of claim **23**, further comprising measuring positions of the  
2 reaction mass relative to the elongated member with a displacement sensor.

1 26. The method of claim **23**, further comprising measuring position of the reaction  
2 mass with a displacement sensor transmitting a value indicative of its measured  
3 position to a controller using a feedback loop, and controlling the acoustic actuator  
4 with the controller.

1 27. The method of claim **23**, wherein inducing its reciprocating movement is  
2 accomplished using an acoustic actuator selected from a group consisting of (i) an  
3 electromagnetic drive, (ii) a linear electromagnetic drive, and (iii) a fluid control  
4 device.

1 28. The method of claim **23**, further comprising biasing the reaction mass  
2 position with the biasing element.

1 29. The method of claim **23**, wherein inducing reciprocating movement in the  
2 reaction mass is inducing a reciprocating movement at the predetermined frequency.

1 30. The method of claim **19**, wherein the predetermined frequency is a  
2 resonant frequency.

1 31. The method of claim **23** further comprising controlling fluid flow within the  
2 elongated member with the acoustic actuator, the control flow being used to  
3 cause the reciprocating movement.

1 32. The method of claim **31**, further comprising using an actuator selected  
2 from a group consisting of (i) a poppet valve and (ii) a rotary valve.

1 33. The method of claim **32**, wherein the rotary valve is selected, the method  
2 further comprising controlling its rotary valve with a motor selected from a group  
3 consisting of (i) a synchronous motor and (ii) a stepper motor.